

CLAIMS

I claim:

1. An automated kinetic solubility assay apparatus for assessing the kinetic
5 solubility of one or more substances in one or more test fluids, the apparatus comprising:
 - (a) a cuvette for automatically receiving a first test fluid and a first
substance, the cuvette having at least two spaced wall sections;
 - (b) test fluid addition means for automatically adding the first test fluid to
10 the cuvette and substance addition means for automatically adding the first
substance to the cuvette to cause initial contact of the first test fluid and first
substance in the cuvette, thereby to produce a first testable mixture;
 - (c) turbidity measurement means for automatically measuring the turbidity
15 of the first testable mixture in the cuvette using energy that is directed to pass through
at least one of the two spaced wall sections of the cuvette, then the first testable
mixture in the cuvette, and then through the other of the two spaced wall sections of
the cuvette;
 - (d) kinetic solubility assessing means for automatically assessing the
20 kinetic solubility of the first substance in the first test fluid from the turbidity of the first
testable mixture in the cuvette;
 - (e) removal means for automatically removing the first testable mixture
from the cuvette.
2. The apparatus of claim 1 further comprising cleaning means for automatically
25 cleaning the cuvette to increase the transmittance of energy that can pass through at
least its two spaced wall sections, and a cleaning activation means to automatically
activate the cleaning means to automatically clean the cuvette to increase the
transmittance of energy that can pass through at least its two spaced wall sections if
the transmittance after the first testable mixture has been removed from the cuvette is
below a predetermined value.
- 30 3. The apparatus of claim 1 wherein (i) the substance addition means comprises
means for automatically repeatedly adding the first substance to the cuvette and/or
the test fluid addition means comprises means for automatically repeatedly adding
the first test fluid to the cuvette; (ii) the substance addition means further comprises
means for halting the repeated addition of the first substance to the cuvette and/or the

repeated addition of the first test fluid to the cuvette after the earlier of either of two conditions occurs: the number of additions of the first substance or the first test fluid to the cuvette exceeds a predetermined value or the turbidity of the first testable mixture in the cuvette is above or below a predetermined value, (iii) the turbidity measurement means comprises means for automatically measuring the turbidity of the first testable mixture in the cuvette after each addition of the first substance to the cuvette and/or after each addition of the first test fluid to the cuvette.

4. The apparatus of claim 3 wherein the kinetic solubility assessing means comprises means for automatically assessing the kinetic solubility after the addition of the first substance and/or of the first test fluid to the cuvette has been halted.

5. The apparatus of claim 1 further comprising means to automatically rinse the cuvette after the first testable mixture has been removed from the cuvette by the removal means.

6. The apparatus of claim 1 further comprising means to cause:

(a) the test fluid addition means to automatically add a second test fluid to the cuvette and the substance addition means to automatically add a second substance to the cuvette to cause initial contact of the second test fluid and second substance in the cuvette, thereby to produce a second testable mixture, the addition of the second test fluid and second substance to the cuvette occurring after the cuvette has been rinsed;

(b) the turbidity measurement means to automatically measure the turbidity of the second testable mixture in the cuvette using energy that is directed to pass through at least one of the two spaced wall sections of the cuvette, then the second testable mixture in the cuvette, and then through the other of the two spaced wall sections of the cuvette;

(c) the kinetic solubility assessing means to automatically assess the kinetic solubility of the second substance in the second test fluid from the turbidity of the second testable mixture in the cuvette; and

(d) the removal means to automatically remove the second testable mixture from the cuvette.

7. The apparatus of claim 6 further comprising means for determining the transmittance of energy passing through at least the two spaced wall sections of the cuvette in the absence of the first substance, in the absence of the second

substance, and after the first testable mixture has been removed from the cuvette by the removal means and before the second testable mixture is present in the cuvette.

8. The apparatus of claim 7 further comprising cleaning means for automatically cleaning the cuvette to increase the transmittance of energy that can pass through at least its two spaced wall sections.

9. The apparatus of claim 8 further comprising cleaning activation means to automatically activate the cleaning means to automatically clean the cuvette to increase the transmittance of energy that can pass through at least its two spaced wall sections if the transmittance in the absence of the first substance and second substance and after the first testable mixture has been removed from the cuvette by the removal means and before the second testable mixture is present in the cuvette is below a predetermined value.

10. The apparatus of any of claims 1 to 9 wherein the cuvette has a volume of from 0.3 to 5 milliliters and further comprises a first planar surface and a second planar surface parallel to the first planar surface and one of the two spaced wall sections of the cuvette is a portion of the first parallel planar surface and the other spaced wall section of the cuvette is a portion of the second parallel planar surface.

11. The apparatus of any of claims 1 to 9 wherein the first substance is in a container having a pierceable septum, the cuvette comprises a pierceable septum, and the apparatus further comprises needle manipulation means and a septum-piercing needle having a passageway, the needle and needle manipulation means being for (i) piercing the septum of the container with the needle, (ii) withdrawing the first substance from the container after the needle pierces the septum of the container and holding the withdrawn first substance in at least the passageway of the needle, (iii) withdrawing the needle from the septum of the container and piercing the septum of the cuvette with the needle, and (iv) discharging the withdrawn first substance from at least the passageway of the needle into the cuvette after the needle pierces the septum of the cuvette.

12. The apparatus of any of claims 1 to 9 comprising a plurality of cuvettes, each cuvette being operatively associated with test fluid addition means, substance addition means, turbidity measurement means, and removal means.

13. A septum-piercing needle having a straight upper portion, a curved lower portion, a longitudinal axis, a piercing end at the end of the curved lower portion, and a non-piercing end in the straight upper portion; the needle comprising a rigid

exoskeleton lined with a corrosion-resistant cannula having a central elongate passageway running from the piercing end of the needle to the non-piercing end of the needle, the passageway of the cannula has an average diameter and a length and the average diameter is from 100 to 300 microns and the length is from 10 to 150 millimeters, the passageway of the cannula further being adapted to hold fluid and terminating at the piercing end of the needle in an opening, the piercing end of the needle being adapted for piercing the pierceable septum of a container holding fluid to allow fluid to be withdrawn from the container and to flow through the opening of the passageway at the piercing end of the cannula into the passageway of the cannula, the plane of the opening of the passageway at the piercing end of the needle being substantially parallel to the longitudinal axis of the straight upper portion of the needle.

14. A cuvette in which a fluid sample may be placed for testing, the cuvette comprising:
- (a) a bottom, a top, and a wall therebetween and connected to both, the bottom, the top, and the wall together defining an enclosed volumetric space for receiving fluid;
 - (b) a pierceable septum forming part of the top to allow fluid to be injected through the septum into the volumetric space within the cuvette;
 - (c) means to remove fluid from the volumetric space within the cuvette; and
 - (d) a vent fluidly communicating between the volumetric space and the region outside of the cuvette through which (i) gas in the volumetric space in the cuvette can flow to the region outside the cuvette as fluid is injected into the volumetric space in the cuvette through the pierceable septum and (ii) gas in the region outside of the cuvette can flow into the volumetric space in the cuvette when fluid is removed from the volumetric space in the cuvette.

15. A cleaning agent comprising a mixture of ethylenediaminetetraacetic acid from 0.001% w to 50%w and glass cleaner having water, ammonium hydroxide, 2-propanol, 2-butoxy ethanol, and anionic surfactant.